Claims: -

1. A microwave transceiver unit for detecting the level of waste in a feeding conduit that extends into the vertical chamber of a shaft furnace said microwave transceiver unit comprising:-

an elongate body having a configuration adapted for inserting through and reversibly mounting in an aperture provided in the wall of said vertical chamber,

said elongate body comprising microwave transmission/receiving means associated with its first end and operatively connectable to either microwave generating means or microwave detection means;

characterized in that said microwave transceiver unit comprises:

— a metallic wave conductor coupled at its first end to said transmission/receiving means and the second end of said conductor being operatively connectable to either said microwave generating means or said microwave detection means;

— an insulation layer substantially surrounding at least said conductor; and

— an outer metallic layer substantially surrounding said insulation layer.

2. A microwave transceiver unit as claimed in claim 1, wherein the microwave transmission/receiving means comprises an antenna operatively connected to the wave conductor.

3. A microwave transceiver unit as claimed in claim 2, wherein the antenna is substantially frusto-conical having the larger end thereof as a transmitting/receiving face.

4. A microwave transceiver unit as claimed in claim 2, wherein the wave conductor and the antenna are integrally joined.

5. microwave transceiver unit as claimed in claim 2, wherein the wave conductor and the antenna are made from any suitable metal including any one of stainless steel, copper and brass or alloys thereof.

6. A microwave transceiver unit as claimed in claim 3, comprising a screen means covering the transmission/receiving face of the antenna, said screen means being substantially transparent to microwave electromagnetic radiation.

7. A microwave transceiver unit as claimed in claim 6, wherein the screen means are made from any suitable dielectric material.

8. A microwave transceiver unit as claimed in claim 1, wherein the insulation layer is substantially tubular.

9. A microwave transceiver unit as claimed in claim 1, wherein the outer metallic layer is made from steel.

10. A microwave transceiver unit as claimed in claim 1 wherein the elongate body has a substantially cylindrical external profile.

11. A microwave transceiver unit as claimed in claim 1, comprising a sleeve member having:
an external configuration adapted for sealingly mounting said sleeve in the aperture in the wall of the vertical chamber; and
an internal configuration adapted for reversibly accommodating the body sealingly with respect thereto.

12. A microwave transceiver unit as claimed in claim 11, wherein the sleeve member and the body each comprise suitable flanges which are mutually facing when said sleeve member and said body are mounted together.

13. A microwave transceiver unit as claimed in claim 12, comprising a suitable sealing gasket adapted for accommodation between the

mutually facing flanges for sealing the sleeve member with respect to the body.

14. A method for monitoring the level of waste in a feeding conduit that extends into the vertical chamber of a shaft furnace, comprising:

(a) Providing one or more pairs of microwave transceiver units according to claim 1, wherein:

- the elongate body of each microwave transceiver unit is inserted through and reversibly mounted in an aperture provided in the wall of said vertical chamber;
- said elongate body has an axial dimension such that the first end of said body extends into said vertical chamber from said aperture at least into proximity with, but not in contact with a first screen transparent to microwave radiation, which is mounted over a suitable portal provided in the wall of said feeding conduit;
- during operation of said microwave transceiver unit, at least a portion of said first screen is in aligned relationship with the microwave transmission/receiving means of each of said microwave transceiver units and wherein said first screen is sufficiently large to maintain an aligned relationship between at least a portion of said first screen with respect to said

microwave transmission/receiving means for a range of displacements of said first screen with respect to said microwave transmission/receiving means; and

- the second microwave transmission/receiving means of each of said pairs is positioned substantially diametrically opposed to the first transmission/receiving means of the pair;

(b) transmitting suitable microwave radiation via one of said first or second microwave transmission/receiving means and receiving a received radiation with the other one of said first or second microwave transmission/receiving means; and

(c) comparing the intensity of the received radiation with the transmitted radiation to determine the level of waste in said feeding conduit by relating said comparison of intensities to a threshold value.

15. A method for monitoring waste as claimed in claim 14, comprising more than one pair of microwave transceiver units, wherein each of said pairs is located at a different height along the depth of the conduit.

16. A method for monitoring waste as claimed in claim 14, comprising more than one pair of microwave transceiver units, wherein each of said pairs is located at a different angular disposition with respect to a longitudinal axis of the conduit.

17. A method for monitoring waste as claimed in claim 16, wherein adjacent pairs are arranged in orthogonal relationship with respect to a longitudinal axis of the conduit.

18. A method as claimed in claim 14, wherein the range of displacements is correlated to the thermal expansion of the wall of the feeding conduit with respect to the wall of the vertical chamber.

19. A method as claimed in claim 14, wherein the body is distanced from the first screen means sufficiently to permit displacement of said first screen means with respect to the microwave transmission/receiving means.

20. A method as claimed in claim 14, wherein the body comprises displacement means in abutting contact with one of the wall of the feeding conduit and the first screen means to permit displacement of said first screen means with respect to the microwave transmission/receiving means.

21. A method as claimed in claim 20, wherein the displacement means comprises at least one wheel mounted for rotation with respect to the body, wherein said wheel is in rotatable contact with at least one of the wall of the feeding conduit and the first screen means.

22. A method as claimed in claim 21, comprising at least one suitable rail on at least one of the wall of the feeding conduit and the first screen means corresponding to the at least one wheel, wherein during operation of the transceiver unit, said at least one wheel is in rotatable contact with a corresponding said rail.

23. The method of claim 14, wherein only a first pair of microwave transceiver units is provided and when the intensity of the received radiation is below a predetermined threshold value it is determined that the level of waste is substantially below the level of said first pair.

24. The method of 14, wherein only a first pair of microwave transceiver units is provided and when the intensity of the received radiation is at or above a predetermined threshold value it is determined that the level of waste is substantially at or above the level of said first pair.

25. The method of claim 14, wherein a second pair of microwave transceiver units is provided at a location longitudinally displaced from the first pair of microwave transceiver units, and wherein a waste flow rate in the furnace is determined by determining the

time interval between the point at which it is determined that one of said pairs of microwave transceiver units is no longer detecting waste and the point at which the other pair of said microwave transceiver units is no longer detecting waste thereat.

26. The method of claim 14, wherein the threshold value may be controlled as desired.

27. The method of claim 26, wherein the threshold value is adjusted according to the general composition of the waste being introduced into the furnace.

conduit would be difficult to maintain and replace, typically requiring dismantling of the upper part of the chamber and/or the feeding mechanism. Furthermore, the thermal expansion of the feed tube with respect to the ceramic lining of the chamber also presents a problem in that the electrical connection between such detectors mounted to the conduit and the outside of the chamber needs to be expandable. On the other hand, prior art detectors that are mounted on the outside of the processing chamber would not be able to detect the level of waste within the conduit itself.

A microwave transmitter receiver arrangement for detecting the level of waste is generally known from JP 10307053 and JP 20310554. Other prior art publications, such as US 3,456,715, US 6,810,574, US 5,703,289, US 5,507,181, US 4,566,321, and JP 57029913 relate to various level monitoring systems which are boltable to a casing which contains the material whose level is to be monitored. US 3,456,715 relates to an ultrasonic-based system for detecting the level of melt in a solidification water cooled collar. Ultrasonic based systems, however, are generally unsuitable for height detection in such processing chambers because of the influence of the ultrasonic background signals generated by the processes inside the chamber.

International Patent Application WO 03/078897 by the same applicant describes a control system for a waste processing apparatus. The control

system is designed to control the feeding of waste based on measurements of the level of waste within the apparatus.

None of these documents is directed to providing a solution to the problem of monitoring the height of waste in a high temperature environment within a